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"ORCHARD COVER CROPS"

A Paper by

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Orchard Cover Crops

Cover crops are highly essential to the present success of the orchard, but especially to its future success—the lack of it may explain failure.

Mr. Todd requested that we talk on this subject one year ago. We declined, believing that others could better give the desired information. Again when the subject was assigned we requested Dr. Howard to give it to some one else. The more we learn of cover crops the more we appreciate its importance. Personally we have had more or less experience in our plants in Missouri and other states. We have observed the cover crops used in the Peach orchards of Georgia and other southern states, of the Lake Shore country of New York, of Michigan, Ohio, Maryland, Delaware, etc., and throughout our own state and particularly the cover crops—and too oft' the lack of them—in the West and Northwest. Oft' times we hear the orchardists explain that we don't get the crops of the old times when this was a virgin country. To repeat such crops, one essential necessary is to put the soil in as near the fertile condition it was following the removal of the forests. The mineral elements of the soil remain but the humus has been "burned out." Too many orchards are starving, actually starving—and especially is this true of our Ozark regions. We have heard in these meetings, the advocacy of weeds as a cover crop. Perchance weeds may be better than nothing, but is that good, up-to-date teaching? Orchardists interested will find in the Bulletins of the Department of Agriculture, in various State Experiment Bulletins, particularly Ohio, West Virginia, etc.—from which we are quoting generously—much valuable experience and information. The report of the Iowa State Society some years ago gives valuable information concerning the hardiness and value of Hairy Vetch as a cover, particularly for such regions as are too cold for the growth of the Southern Cow Peas.

The average soil on chemical analysis shows a fair to a large amount of potash, phosphate and other necessary elements. It is not a question of buying a car-load of fertilizer and wondering if it will pay. Commercial fertilizer may pay, and often does; and it is sometimes necessary when the soil has been worn out, but where soil contains the necessary minerals and the air the necessary nitrogen, the question should be only one making use of what you already have, by putting it into an available form and not of buying a few tons of fertilizer. The nitrogen will be supplied by the leguminous crops from the atmosphere. The organic matter which is also added by these leguminous crops tends to make the mineral of the soil more available and with proper management most soils will furnish all the necessary potash, etc. A little green manure should be added every year which will increase the nitrogen. This is the cheapest method as it can be done by means of cover and catch crops at the end of the growing season when other crops have been removed.

Where any cover crop or manure is turned under, it forms humus which makes the soil darker, and by test it has been shown that a dark soil is some degrees warmer than the same soil when lighter in color, when under the same conditions.

Humus in the soil makes it act like a sponge. It makes the soil more porous and able to hold more water and retain it longer. It makes a stiff clay soil of lighter tilth by separating and loosening the soil particles rendering cultivation easier.

There are a number of bacteria working in the soil. They must all have food, and the beneficial ones are dependent, more or less, on humus and the decaying organic matter from which it is formed. When these bacteria work or "digest" the humus, they set free carbon dioxide. The carbon dioxide is a gas which is taken up by the soil water. This solution is then able to dissolve many insoluble minerals from the soil which are necessary as plant food. Such substance as rock phosphate, which are practically insoluble in pure water, are made soluble and available as plant food by the action of this carbon dioxide in water. It is this carbon dioxide in water that forms the lime-stone caves. Pure water alone can not dissolve lime-stone.

Humus is partially decomposed vegetable matter. It is not completely decayed. When the vegetable matter forms humus, or the humus breaks down to form still simpler compounds, heat is liberated. Whether a pile of leaves is burned or allowed to rot, the same amount of heat is given off in either case. This means the decaying organic matter in the soil makes it warmer and drier in the spring. Thus growth will start earlier and be faster throughout the entire season.

Speaking of some personal experiences with cover crops, my son and I have an orchard of about 200 acres, closely planted, at Rolla, Missouri—in the heart of the Ozark country. For six years we have made a study there of cover crops in a commercial way, and I have personally given considerable attention to it, and have kept in close touch with the experimental work done at the various stations. It is our opinion that to some extent the barren condition of the orchard is chiefly due to impoverished and starved condition of the soil, naturally deficient in humus. Therefore, our policy has been not to rob the soil, but build it up for anticipated crops by adding to its strength wherever possible and by preventing any loss always having growing crops ready to take up food not required by the trees.

Bacteria working in the soil, especially during warm weather are continually setting free food in the form of nitrates and other minerals are also changing to soluble form. The nitrates, unless used immediately, are liable to be lost by leaching away in the drainage water. There are some minerals also more or less soluble that may be lost by washing away in drainage water. However, their loss is not so great as that of nitrogen. To avoid this, a crop is necessary during the whole growing season. At the first of the season, the orchard while growing, can handle and use all of this available plant food. Later on, when the orchard growth is less active, it is necessary to have a cover crop of some sort to use this food and get it in a form that can be carried over until the next season without loss. Such crops as clover are especially good. They not only use all the available nitrogen in the soil, but they add more from the air, and in the spring they decay readily, liberating their contents to be used by the trees.

The ideal cultivation for orchards in the central west is, we believe, intensive, clean culture from early spring to June, then seed to Cow Peas—either drilling and cultivating or broad casting. In this connection, the Western Fruit Grower says:

"Regarding cover crops for the middle West will say that we agree with you that nothing is better than cow peas, except that lots of orchards are on hills so steep that it will not do to give them cultivation in early spring, during the rainy season. We think that very soon we shall have to adopt a plan of cultivating two rows and leaving the next two rows in clover and alternating this treatment "

There are numerous and various varieties of Cow Peas adapted to the different orchard regions. Occasionally, we have followed a crop of Cow Peas with a crop of corn. During the last cultivation of the corn more Peas are sown, or Hairy Vetch. The Vetch supplies a fine crop for plowing under in the spring. Vetch also becomes a profitable pasturage crop for hogs when their age and size will permit pasturing them without injury to young trees. On this subject of Hairy Vetch, Agrostologist F. Lamson Scribner in 1895 reported:

'Hairy Vetch sown in autumn will cover the ground and prevent wash ing during the winter. It is one of the best crops to turn under as green manure. Do not commence to feed hairy vetches until they have begun to bloom. Like most of the bean and clover family they are somewhat diuretic if fed in large quantities before mature. Use caution in feeding until the animals have become accustomed to the change of feed.'

Peas may be utilized in the same way—just as you would clover. We have occasionally used a crop of Red Clover but its use is too familiar to need further comment here. We have also used Alsike Clover which in some cases is better than Red Clover.

Some sort of cover crop throughout the winter not only prevents washing, which is so disastrous, but holds the winter snows, and lessens the depth of alternate freezing and thawing. Also, in gathering the crop in the fall, it makes picking and hauling of fruit a much cheaper, and cleaner job.

The rapid growth induced by cultivation through the first of the season is inclined to make the new wood of the trees soft and tender. To check this growth and harden the wood for winter, a cover crop is necessary. The weeds or volunteer grass might be allowed to fulfill the same purposes, but they do not add the same amount of fiber to the soil, and they certainly add absolutely nothing in the way of nitrogen from the air.

During the several years, I have traveled over considerable country, particularly the Ozark region of Missouri and Arkansas, and I may be pardoned for stating that the strongest, healthiest, most vigorous growth I saw on these trips was in this Rolla orchard thus cultivated. And I believe that by a generous use of cover crops in orchards throughout the state, particularly on the thinner soils, the value of the crops may be continually increased. Also the life and productive age of the orchard materially increased.

Rye has been used to a limited extent, but it has not been so successful a crop in the Rolla country as Peas, Vetch and Clover. When the trees

are getting too much nitrogen, the growth is rank and succulent; cover crops are just as necessary but rye or some other non-leguminous crop should be used. It gives humus and protection without adding more nitrogen, and also serves as a check which helps the formation of fruit buds. Quoting from a bulletin on the subject:

"While in general the use of a cover crop in cultivated orchards is advantageous, there are cases where if used injudiciously it may actually be detrimental. One such case is the use of rye upon a soil naturally dry and gravelly; especially if the crop be left late in the spring before plowing under. This treatment may result in so drying the soil as to seriously interfere with the growth of the trees. On soils of the nature indicated, one of the vetches, oats or clover is to be preferred; particularly if the land is not to be plowed promptly in the spring."

The growing of Spanish Peanuts in young orchards is worthy of a trial. We have also used Velvet beans which we believe are adapted to conditions further south where the season is longer and will mature the crop.

During the past season in company with Mr. Irvine, editor of the Fruit Grower, I visited the orchard regions of Colorado, Utah, Idaho, Oregon, Washington, and Montana. We made it a point to inquire about cover crops. Generally our Western friends—and we may add that the most successful ones are generally from Missouri—all admitted that they knew little about them and felt their need, some had had little experience with clover. Their soil rich in minerals is often deficient in humus. This is one of the greatest problems they have to solve, and is one to which they should give far more attention.

There are many forms of mineral plant food in the soil which are not available to many of our cultivated plants. Even under the best conditions they have not the power to use them. On the other hand, certain of our cover crops can digest these less available foods, and when they decay leave them in the form convenient for other weaker plants.

Many plants cannot work below the surface layer of the soil, that is they cannot go down into the sub-soil. Sub-soil contains a large amount of mineral, in fact, the surface layer is merely a sub-soil to which humus has been added by the growing plants. This sub-soil is very rich in the necessary elements, and it is the clovers and other cover crops which send down their roots into the sub-soil and bring to the surface foods which other plants can not reach. They not only bring these foods to the surface but the roots remain down there and decay. Eventually the sub-soil is incorporated with the surface soil, or in other words, the surface soil is made deeper by these roots working around in the sub-soil, loosening it up and adding humus to it.

The higher elevations are not adapted to the growth of Cow Peas, but doubtless our Plant Breeders will give us hardier strains and varieties adapted to every condition. Clover can be used advantageously but perhaps it is not the ideal crop for these localities where intensive cultivation is practiced. The Hairy Vetch is probably one of the best crops suited to such method. Intensive clean culture can be given until mid-summer, then sowing Vetch and turning it under the following spring. We have found Canadian Peas

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a most desirable cover crop in the Genesee Valley of New York. These Peas are also utilized very largely in New Mexico. This is a great crop for the fattening of lambs and hogs, and here is a suggestion that may be of some value to the West, grow these Peas as a crop for the fattening of sheep and hogs, thereby manufacturing at home a most valuable brand of fertilizer which is one of the most effective methods of supplying the humus required by Western soils.

While in the West we noticed a few orchards sown in clover and for partial cultivation they plowed a strip and left a strip. The strip left standing thus became a seeder for the strip turned under, and so caused fairly good cultivation.

Captain Shawhan, a grand old man of Payette, Idaho, the products of whose orchards attracted most favorable attention and some blue ribbons at the Council Bluffs Apple Show, and also at the Spokane Apple Show—believes in cover crops, and the adding of humus to the soil, thus feeding his trees. He says when he takes such wondrous crops of fruit from his trees that he feels duty bound to give them something in return. Therefore, in addition to cover crops he makes generous application of barn-yard manure, and the soil is so porous and loose that in walking through the orchard one sinks to his shoe tops. Our Mr. Todd will also remember with pleasure his visit to the orchard of Capt. Shawhan where the orchards were so laden with crops that the orchard middles almost resembled the poles in a hop field. We believe that Capt. Shawhan has come nearer solving this problem than any other orchardist of the far west. His location is one peculiarly adapted to Red Clover and one of the most beautiful sights of our entire trip was the magnificent Red Clover fields in the Twin Falls country in the Snake River Valley, yielding, we were told, from \$80 to \$110 worth of seed per acre. Seemingly, that is the country that should be devoted to producing the ideal clover seed for the Clover world.

In planting a later addition to the Rolla orchard, consisting of 15,000 trees, mostly one year, but with some two year, we applied to each tree several pounds of Commercial 583 and bone meal. Every tree lived, not ONE failed to grow and all made a vigorous growth. Planters of Western orchards on land deficient in humus have supplied the deficiency by this method rather than lose a year's time in the cultivation of some crop. We suggest that each tree be given, at the time of planting, several pounds of sheep or other manure, or some commercial brand of fertilizer as may be convenient. Abundant humus may then be supplied by the cover crop to follow. This method is also suggested for old lands lacking in fertility. The money and time spent in applying a stimulant will prove a profitable investment.

